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Duck Growing

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Duck Growing in New York State

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The Duck Industry in New York State

According to the 1950 census, New York raises more ducks than does any other State. The number reported is 4,217,418, or 40.7 per cent of the total for the United States. This figure is probably conservative, as many duck farms on Long Island raise more than 100,000 ducks annually. No other State has developed the commercial duck business as extensively as has New York. Suffolk, Erie, and Onondaga Counties lead in the number of ducks reared. Suffolk County alone, according to census figures for 1950, raised 4,042,618 ducks, or 95.8 per cent of all ducks raised in the State. In 1945, the number of ducks marketed from Suffolk County was 6,500,000. Judged by census information for 1910, 1920, 1930, 1940, and 1950, duck raising in New York State has decreased in recent years.

Types of Duck Farming

Duck raising in New York can be classed as: (1) commercial duck raising for the production of duck meat; (2) a by-product on the general farm; (3) for egg production; and (4) breeding for pleasure, exhibition, or the sale of breeding stock.

Most of the ducks in this State are raised for meat, although there is considerable interest in the laying type of ducks.

Opportunities in Duck Farming

Ducks are kept primarily for meat because of their rapid growth, their hardiness, and the ease in handling. A young Pekin duck, when properly grown, should weight between 5 and 6 pounds at from eight to nine weeks of age.

Duck farming as a business is limited because the demand for duck meat is not steady and the meat is not so well liked as chicken meat. The sale of duck eggs also is limited. Most consumers are prejudiced against duck eggs for table purposes because they usually have a strong flavor.

The results of a survey of 37 Long Island duck farms that raised ducks for meat are shown in table 1. This survey shows that feed was the most important item of cost, amounting to 60 per cent of all costs. Next in importance was value of baby ducks and labor costs. The average weight of the ducks produced was 5.6 pounds; the feed to

Table 1. Costs and Returns in Raising Ducks*

37 duck farms, Long Island, New York, 1948

Item	Total per farm
	Dollars
Returns	
Ducks sold dressed	97,549
Ducks sold live	14,254
Ducks sold retail, eaten and gifts	2,521
Ducks on hand	1,128
Ducks transferred to breeder flock	2,146
Feathers and other returns†	5,676
Total	123,274
Costs	
Value of baby ducks	17,064
Labor	13,551
Feed	75,152
Buildings	4,222
Land	760
Equipment	1,417
Truck, tractor and auto	1,021
Miscellaneous expense	9,817
Interest on duck inventory	209
Total	123,213
Profit	61
Net income to operator for labor	3,038
Return to operator, labor per hour	0.93
Cost per pound of duck produced	0.36

*Production of Long Island Ducks in 1948. By A. Neil McLeod. Bul. A.E. 750. Dept. of Agr. Economics, Cornell University.

†Substitutes for feathers have greatly reduced the returns from feathers since 1948.

raise a duck was 27 pounds; the mortality was 10 per cent, and the cost of labor to raise 100 ducks varied from 21.4 to 27.3 cents, depending on the number of ducks raised on the farm. The cost per pound of duck produced was 36 cents.

The largest return was from the sale of dressed ducks, with the sale of live ducks second, and feathers third. The return from feathers is an important item on the farms surveyed. On the average farm, the returns exceeded the labor income. The duck growers are afraid, however, that synthetic materials for the bedding industry may reduce the demand and market for feathers. The average return per hour of labor to the operator was 93 cents. Of course, costs and net returns vary from year to year with the cost of feed and other things and with the price received for the ducks sold. The average capital investment, which included land, buildings, equipment, and stock, was $77,367.

A ten-year comparison between hens and laying ducks at the Harper Adams Laying Trials in England (1929–30 to 1939–40) is given in tables 2 and 3. A study of these tables shows that ducks laid more eggs but consumed much more feed than did hens. Duck eggs were heavier than hen eggs, and there was much less mortality among ducks.

Many poultrykeepers have been interested in changing from hens to ducks when losses from disease and parasites have been high, because of the lower mortality among laying ducks. This advantage is more than offset by the increased cost of feed, for laying ducks require about half again as much feed during the rearing period, and to produce a dozen eggs, as do hens.

The laying type (Indian Runner) duck will, when properly fed and bred, lay as many eggs as the best of the popular breeds of fowl. They lay larger eggs than do chickens, but consume much more feed in producing them. Except at Eas-

Table 2. Ten-Year Results with Ducks at the Harper Adams Laying Trials in England (1929–30 to 1939–40)

Year	Birds entered	Average eggs per bird of birds that lived	Average eggs monthly per bird	Size of egg	Average feed monthly per bird	Percentage of mortality
	Number	*Number*	*Number*	*Ounces*	*Pounds*	*Per cent*
1929–30	172	234.1	19.5	2.52	12.02	2.3
1930–31	114	232.4	19.4	2.58	12.33	1.8
1931–32	132	241.1	19.9	2.59	11.86	3.0
1932–33	123	244.2	20.4	2.59	11.77	4.9
1933–34	151	233.8	19.5	2.53	11.67	3.3
1934–35	83	229.0	19.1	2.62	12.31	8.4
1935–36	133	236.7	19.7	2.65	11.43	8.3
1936–37	176	224.0	18.6	2.58	12.06	5.1
1937–38	113	228.4	19.0	2.60	12.14	2.7
1938–39	96	233.3	19.2	2.67	12.10	7.3
1939–40	85	216.2	17.5	2.57	11.73	3.5
Average	125	232.1	19.3	2.59	11.95	4.6

Table 3. Ten-Year Results with Hens at the Harper Adams Laying Trials in England (1929–30 to 1939–40)

Year	Birds entered	Average eggs per bird of birds that lived	Average eggs monthly per bird	Size of egg	Average feed monthly per bird	Percentage of mortality
	Number	*Number*	*Number*	*Ounces*	*Pounds*	*Per cent*
1929–30	1,837	182.2	15.0	2.10	7.84	8.8
1930–31	2,025	178.9	14.7	2.12	7.68	10.7
1931–32	2,025	184.2	15.1	2.14	7.67	15.5
1932–33	2,034	184.1	15.1	2.16	7.65	14.8
1933–34	2,030	183.7	14.9	2.15	7.62	16.4
1934–35	2,049	175.6	14.2	2.15	7.80	20.0
1935–36	1,585	180.9	14.6	2.19	7.62	20.2
1936–37	1,501	175.9	14.1	2.18	8.03	21.3
1937–38	1,171	187.2	15.2	2.17	7.73	18.0
1938–39	1,102	179.8	14.0	2.18	7.30	18.2
1939–40	1,062	176.8	14.3	2.16	7.45	14.0
Average	1,675	180.8	14.7	2.15	7.67	16.2

ter time, the price of duck eggs is usually several cents less than that for hens' eggs.

It is claimed that Indian Runner ducks lay as well in their second, third, and fourth year as in their first. Such scattered information as is available (Thompson, 1913) shows that the egg production of a flock of laying ducks decreases annually with each year of their age much the same as it does with hens.

Before undertaking to raise many ducks, either for meat or eggs, the possibilities of disposing of the finished product should be considered. Summer resorts and large cities with a foreign population make the best markets.

Location for Duck Farms

DUCKS do best on sandy soil. The land should slope gently to ensure better drainage and sanitation. A slow-running stream is best for the breeders, as the fertility of the eggs is usually better when the ducks have access to water. Most of the commercial duck farms on Long Island are on the southern

shore of the island along fresh-water inlets which empty into the ocean. This is an ideal location since it supplies water yards for the breeding ducks, or the growing ducks if desired. The continued use of these streams by ducks for many years has, however, polluted the water to the extent that shellfish will not live where these streams empty into the ocean and they are unfit for public bathing. The state health department has requested other means of supplying water for the ducks. Contrary to the opinion of most growers, ducks do not require a large area of water or unlimited conditions for swimming and diving. They get along well in a shallow, slow-running stream if they have all the fresh water they want to drink and enough space to enable them to keep their plumage clean. The best arrangement is a shallow ditch lined with cement and supplied with clean water from a pipe line or reservoir flowing slowly and continuously through the trough. Attention should be given to the disposal of the water contaminated with manure and filth after it passes through the yards. It can be pumped from a central collecting point by pipe line to a distant field or into tanks on trucks and spread on the land.

A site near a railroad and on good roads within easy trucking distance from a large city where ducks are in demand is essential. Large flocks of ducks are noisy and the pens sometimes smell badly, especially in summer. Thus, a somewhat isolated situation is best.

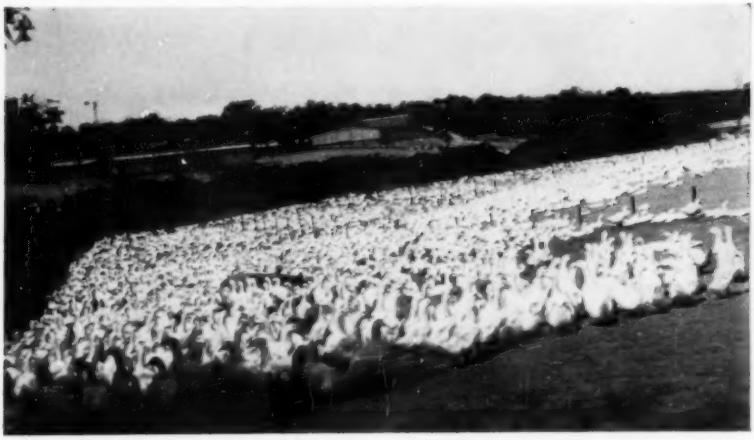

Figure 1. A flock of Pekin ducks on a Long Island duck farm
The soil is sand, and the yard slopes down to the water.

Figure 2. A shallow cement-lined ditch for water
This is a good way to provide running water for ducks to drink and to bathe in.

Houses for Breeding or Laying Ducks

Kind of houses

The number of buildings required for duck raising depends on the size of the flock. For small flocks, a barn, shed, or colony brooder house, such as is used for chickens, is satisfactory. Where several hundred or thousands of ducks are raised, more complete equipment is needed. On the larger farms there should be buildings for the breeding or laying stock, an incubator cellar, brooder houses, and places for storage, for feed mixing, and for killing. One-story buildings are better than two-story houses, because ducks must have easy access to land. Shed-type buildings, similar to those made for chickens, can be used. Complete details of the Cornell shed-type house may be obtained from the Department of Agricultural Engineering at the New York State College of Agriculture, at Ithaca, New York.

Both the number and the size of the brooder houses and brooding outfit depend on the number of ducks to be raised. The large farms have hot-water heating systems. For a few hundred ducks, colony houses 10 by 12 feet are satisfactory.

Some farmers have an incubator cellar under one of the brooder or laying houses while others use the house cellar.

It is usually best to face duck houses toward the south. This is not so important as for chickens, since ducks use them mostly at night.

Ventilation

The amount of moisture in duck houses requires good ventilation. The system of ventilation used in the Cornell shed-type house is effective, easy to install, and cheap. Complete details are given in Cornell Extension Bulletin 315, *The Ventilation of Poultry Houses.*

Floors

Dirt floors are generally used in duck houses when the soil is sandy and well drained, but cement floors are recommended because they are easier to clean and more sanitary. In either, the top surface of the floor should be about 1 foot above the ground level and well covered with sand or bedding.

Litter

Straw, shavings, or sugar-cane fiber usually make the most satisfactory litter.

In cold weather the litter may be allowed to accumulate in the laying houses, provided it is reasonably dry, as litter helps to keep the birds more comfortable. New litter is added more or less frequently, depending on the weather and on the condition of the bedding. It adds materially to the dryness and cleanliness of the litter and prevents frequent changes if as much of the feeding and watering as possible is done on the outside of the house. If the water supply must be inside the house, it should be carefully arranged so that the slop from the containers falls through a wooden or metal grating into tile drains or into a concrete trough which can be flushed out.

Capacity of buildings and size of flocks

When considering the amount of housing for either the laying or the meat type of ducks, it is advisable to allow from 3 to 4 square feet for each duck. Breeders or layers of both types may be kept in flocks of from 10 to 300, 400, or more, although from 100 to 150 seems to be the preferred number on some of the larger farms. The smaller the number of breeders or layers in one flock, the better they are likely to lay There are less cripples and fewer broken eggs in the smaller flocks. For several hundred or thousands of ducks, the cost of equipment and the labor involved are increased if they are kept in too small flocks.

Nests

Some duck growers say that nests are unnecessary and that the birds prefer to scoop out a nest in the litter. As a rule, growers provide nests around the walls of the pens on the floor. Each nest should be about 12 inches wide, from 14 to 18 inches deep, and 12 inches high. The partition pieces can be held in place by nailing them to a 1-by-5-inch strip which forms the front of a series of nests. This leaves the top and front open when the other end of the nests rest against the sidewall of the pen. Nest boxes used on a Long Island duck farm are shown in figure 3.

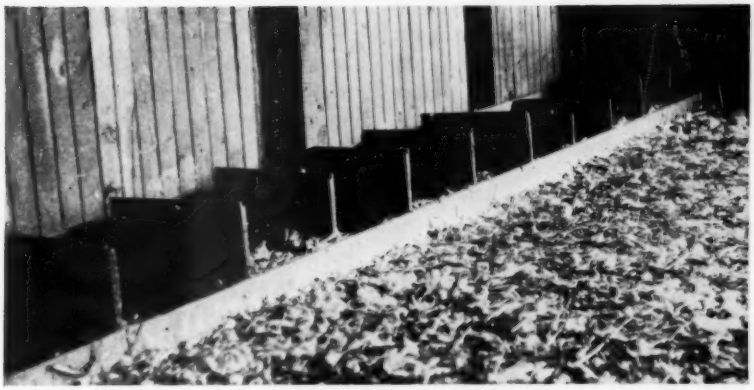

Figure 3. Nests in a duck house

Lights

Ducks are easily frightened at night; consequently, most of the large duck farms have dim artificial light of some kind in the brooder houses to prevent the ducklings from stampeding. A 15-watt electric lamp at least 6 feet from the floor gives ample light in a 20-by-40-foot pen.

Artificial light also stimulates and controls the production of eggs

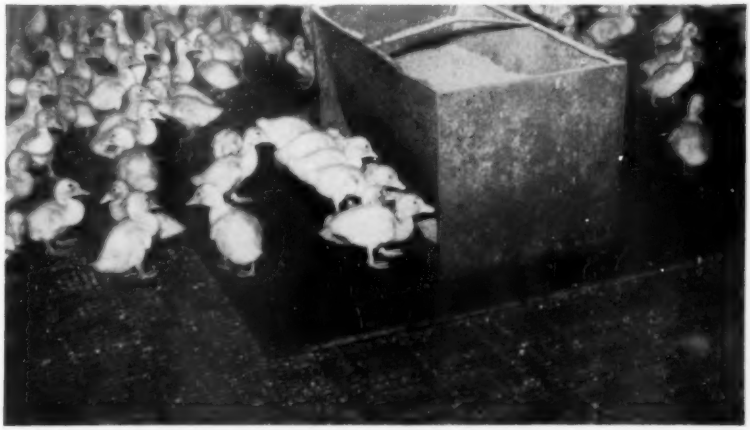

Figure 4. A small pellet feeder on a piece of sheet metal above a wire-covered floor

in the laying flock. Brighter lights are necessary, however, to bring the flock into heavy production rapidly. From 60- to 100-watt lamps should replace the 15-watt lamps during the period when heavy egg production is desired. One lamp should be used for each 200 square feet of floor space.

Other equipment

No perches or dropping boards are used in duck houses, but there must be ample feeding space. One pellet feeder 3 feet long, which holds 200 or 300 pounds of pellets and allows the ducks to eat from both sides, is commonly used for 200 to 300 grown ducks. Smaller feeders similar in type are used for a like number of ducklings (figures 4 and 5).

If wet mash is fed, one tray 3 feet wide, 5 feet long, and 4 inches deep is needed for each group of 50 mature ducks. Ducklings need smaller, shallower trays. During the winter, when laying ducks are confined at night, it is necessary to have troughs, tubs, or pans in the house for water. These should have a drain, to prevent the bedding from getting wet. A pipeline through the house, with a faucet at each water container, saves both time and labor.

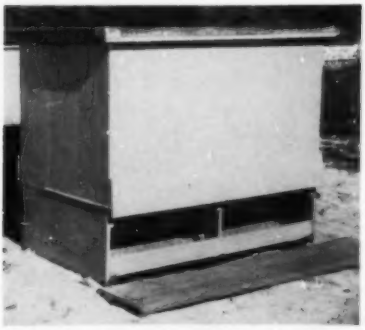

Figure 5. An outdoor pellet feeder for growing ducks

Yards

MEAT-TYPE ducks are usually confined to yards. The size of the yard depends on the size of the flock. For 200 ducks, a yard 50 by 300 feet is large enough. A shallow-flowing stream of water should pass through the yard. Some movement of the water is necessary to keep it clean and fresh. When large numbers of birds occupy a yard, sloping land and sandy soil help to keep it clean. Even with these conditions, the top surface of the yards should be removed frequently to keep them sanitary (figure 6).

Usually wire or slat portable fences about 2 feet high are satisfactory to enclose the yards. Permanent fences interfere with cleaning and with changing the size and location of the yards.

Market ducklings are allowed in the water in mild weather when they are 5 or 6 weeks old and in cold weather at 7 weeks of age.

On large farms, a flowing stream of water saves considerable labor in watering and cleaning and helps to keep the young ducks in better physical condition and cleaner. In warm weather, the ducklings devel-

Figure 6. Removing the top surface of a duck yard to make the yard more sanitary

op frame and muscle better if they have a chance to bathe in a running stream.

It is not so important to have yards with running water for laying ducks, but more land is needed for the laying than for the meat-type of ducks as they are active foragers. They do well, however, when confined to small yards. A regular supply of drinking water is always essential.

Selection and Management of the Breeding and Laying Stock

Age of breeders

It is the custom on the large meat-duck farms to use one-year-old ducks as breeders. Some growers keep a part of their breeders for two years or more, but generally the breeders are selected each year from the young stock. Drakes may be used for two years. The average yearling Pekin duck lays from 135 to 150 eggs during the breeding season. The Indian Runner ducks lay more than this number.

Experienced duck growers are of the opinion that ducklings hatched from the eggs of carefully selected two-year-old ducks live longer than do those hatched from eggs of younger ducks. The selection of older, well-matured breeding stock is just as important with the meat type of duck as with the laying type. Some growers keep from 25 to 40 per cent of the yearlings as breeders the second year. Breeders are selected at the end of the laying season and when the young birds are ready for market. Of course, the older the breeders are, the lower

will be their average annual production.

Selection of breeders

Whether for meat or egg-laying purposes only the most vigorous and best developed ducks and drakes should be saved for breeding. The meat type of duck, such as the Pekin, should have a broad, full breast; a deep keel; broad, long back, with width between the legs; and medium to large heads. The legs should be straight and strong. To determine this, each bird should be given a walking test. It is important to have the flock uniformly large so that the ducklings will dress about 6 pounds when marketed. Average egg production can be improved by selecting the ducks in the same way hens have been selected for years for persistency in laying. In addition to general body conformation suggested above, attention is given to the loss of yellow pigment in the shank, feet, and bill, to time of molt, and to condition of the abdomen. Of course, these observations can only be made on the yearling ducks at the close of the laying year. Birds showing a bleached condition and late molting are best.

The type of the laying duck is much the same as that of the meat duck, except that the laying duck is smaller and more refined, and usually stands more erect. The best layers are small-boned, with sharp, fine heads. They are active and

Figure 7. White Pekin breeder ducks individually trap-nested

Each duck is trapped when she enters a nest to lay. There are as many trap-nests in the house as there are female ducks in the pen. The ducks in each pen are individually mated to one drake.

have bright, prominent eyes set high in the skull.

English breeders suggest that the ducks which start laying first be selected if they are suitable in body conformation, size, and the like. The drakes should also come from a parentage of early layers. Where possible, both ducks and drakes should come from pedigreed stock. This makes it necessary to trapnest the breeders and to pedigree hatch the ducklings the same as is done with hens. Progeny-testing records of production, viability, and the like, which have been so valuable in developing domestic fowl, are equally important for ducks.

Number of females to each drake

From five to six ducks are mated to each drake, starting with the fewer number in cold weather and increasing as the season advances and the weather becomes warm. The breeding flock may be of any size up to several hundred birds, as the drakes seldom fight or bother each other.

Management and care of hatching eggs

Most of the laying is done very early in the morning; consequently, the work of gathering the eggs is made easier by confining the ducks to the house until 9 or 10 o'clock in the forenoon. Also, ducks that have access to a pond or stream early in the day may lay in the water and some eggs may be lost. Eggs for hatching should be kept in a cool pace. A cellar is the best place on most farms. The temperature of this room should be from 50° to 60° F., and the relative humidity at least 70° F. Duck eggs, usually dirty when gathered, should not be washed; washing prior to incubation increases the chances of paratyphoid (keel) infection. The storage of eggs does not seriously affect hatching quality if the eggs are stored under the right conditions and are incubated before they are two weeks old.

Determining sex

Drakes are usually a little coarser about the head, larger in size, have higher pitched voices, stand a little more erect than do the ducks, and have a distinct curl in the two sex feathers at the base of the tail. In some breeds there is a sex difference in the color of the feathering.

Scientists in Holland, England, report a method of determining the sex of day-old ducklings similar to the Japanese method followed with chickens. This consists of an examination of the vents for the presence or absence of the rudimentary male sexual organ. It is much easier to determine sex in ducklings than in chickens. Thus far the practise of sexing ducklings has not been used extensively in this country.

The chief advantage of sexing day-old ducklings is with the laying breeds where only the females are saved. In such instances the drakes can be killed immediately and the

producer is spared the expense, the extra brooder space, the labor, and the trouble of marketing the drakes.

Oftentimes the drakes are sold at a loss. With the meat breeds, segregating the sexes is not so important, as usually both sexes are marketed at the same time. Some growers of meat ducks, however, like to give the females saved for breeders different management from the birds marketed, and, therefore, sexing the ducklings at hatching time may be of value.

The method of determining sex is the following:

1. Hold the legs of the day-old duckling firmly between the first and second fingers of the left hand, with the neck between the third and fourth fingers and the breast away from you.

2. Next press gently with the left thumb on the abdomen of the duckling and at the same time press down on the tail with the thumb and forefinger of the right hand. If this is done quickly, the contents of the bowel will be expelled. This makes the examination of the duckling much easier.

3. The next step is to evert the vent of the duckling. This is done by gently pressing down on the abdomen of the duckling with the thumb of the left hand near the vent. At the same time the first finger and thumb of the right hand are placed close together on the opposite side of the vent and then slowly separated with a gentle but firm pressing, forcing motion. This stretches and everts the cloaca exposing the male organ, if the bird is a male. The copulatory organ looks like a pinkish root tip. No such organ can be seen in the female.

Geese can be sexed in the same way.

Feeding

On the large farms where ducks are kept for meat purposes, the breeding ducks and drakes are selected during the summer months and are placed in separate pens. From that time until the breeding season they are fed a ration which will keep them in condition without inducing them to lay.

Rations for layers and breeders

The rations for laying ducks are similar to those for hens. The breeders, too, should have a suitable ration (table 4). The mash part of the ration may be fed as pellets or as wet mash, but ducks should be given all they will eat of either morning and night. The wet mash should be neither too crumbly nor too wet, but of such a consistency that it holds together when squeezed with the hand or, if dropped, falls apart in lumps. A mixture of grains is usually fed in addition to pellets or wet mash. In England it is customary to feed laying ducks the hard grain in the water trough. About two parts of mash are fed to one part of grain. Oyster shell or high-grade lime-

Table 4. Duck Ration for Breeder Ducks*

Ingredients	Amount per ton
	Pounds
Alfalfa meal	100
Corn meal	300
Pulverized oats†	300
Wheat flour middlings } †	300
Wheat standard middlings } †	600
Soybean meal, 44 per cent	50
Fish meal	150
Dried brewers' yeast	60
Distillers' solubles or low-lactose whey product	50
Limestone	60
Dicalcium phosphate	20
Riboflavin supplement (BY-21)	0.25
Stabilized vitamin A, 4000 International chick units per gram	2
D-activated animal sterol, 1500 International chick units per gram	1
Salt, iodized	6
Manganese sulfate	0.5
Niacin	(30 grams)

*May be fed as 13/64 inch pellets. Ducks should also be given access to oyster shell.

†If ground whole wheat is used, substitute 500 pounds of wheat and 100 additional pounds of pulverized oats for the 300 pounds of flour middlings and 300 pounds of standard middlings, making 400 pounds of pulverized oats, 500 pounds of ground wheat, and 300 pounds of standard middlings in the final mixture.

stone grit should be supplied to provide calcium for egg-shell formation. In addition, granite grit or gravel may be available in each pen.

Grain mixtures suitable for either egg or meat type of ducks kept as breeders are given in table 5.

The Harper Adams Agricultural College advocates the following method of feeding laying ducks when grain and mash are used.

The first feed is given when the ducks are being released from the trapnests. This consists of 1 ounce of grain per duck, given in the water trough. The second feed, given at 11 a.m., is wet mash, the quantity allowed being rather less than one-half of their total daily mash ration. The third feed, given in the afternoon, is the rest of the mash, and also 1 ounce of grain placed in the water trough as in the morning. Each duck, therefore, receives about 2 ounces of grain and 4 ounces of mash daily.

The average egg production per duck at some duck egg-laying trials at the Harper Adams Agricultural

Table 5. Grain Mixtures for Ducks

Ingredients	Modifications				
	1	2	3	4	5
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Cracked yellow corn	50	65	40	40	40
Wheat	50	35	40	40	40
Heavy oats	..	..	20	10	10
Barley	..	..	..	10	..
Buckwheat	..	..	..	..	10

College, where the method mentioned in the preceding paragraph was in use, was 233.8 eggs. England probably has given more attention to the breeding and management of the laying type of duck than has any other country in the world. In considering her ration and system of feeding, however, it is well to keep in mind that the climatic conditions are different and that English duck growers usually give their ducks a good grass range for about ten months of the year.

Incubation of Duck Eggs

THE period of incubation for duck eggs is 28 days, with the exception of the Muscovy breed which requires from 33 to 35 days. Duck eggs may be hatched either naturally or artificially. Since the Pekin and Runner breeds of ducks are essentially non-broody, it is necessary to use artificial means of hatching or to resort to hens. If only a few ducks are to be reared, the hen is best. The average hen covers from nine to eleven eggs, depending on the season of the year. Ducks usually make unsatisfactory mothers, with the possible exception of the Muscovy breed.

Duck eggs may be hatched in either the still-air or agitated-air incubators, but best results are obtained in the still-air machines. The same general principles govern the artificial hatching of both duck and hen eggs, but in the still-air incubators a slightly lower temperature and higher humidity are needed for duck eggs.

It is best to follow the manufacturer's directions in operating all incubators. The average operating temperature of still-air incubators varies, because of the different rates of air movement in the various kinds of incubators, from 100½° to 103° F. For best results the temperature should be lowered about ¼° F. at the time of hatching. The average temperature for Indian Runner duck eggs should be about ¼ degree higher than that for White Pekin eggs throughout the incubation period. Forced-draft incubators are operated at a temperature of 99.5° F.

Temperature readings in still-air incubators are usually made with the bulb of the thermometer 2 inches from the bottom of the egg tray. The temperature should read higher when the bulb of the thermometer is more than 2 inches above the egg tray, and lower if the bulb is at a lower level. The temperature of the incubator room may influence the temperature at which the incubator is operated. A desirable temperature of the egg room is about 60° F. If the room temperature is low, for example 40° F., the incubator temperature should read about ½° F. higher during the period of incubation; if the temperature is high, for example 80° F., the incubator temperature should read about ½° F. lower. In agitated-air incubators simi-

lar corrections may be made, but not to exceed ¼° F. each way.

In the newer makes of incubators, some provision is made to supply the proper amount of moisture. In the older incubators, especially the smaller ones, this is left quite largely to the discretion of the operator.

The relative humidity during the first 24 days should be 65 to 70 per cent; for the last four days, from 55 to 60 per cent. This applies to all types of incubators. In forced-draft incubators with separate hatchers, the wet-bulb reading for the first 24 days should be from 89° to 92° F.; and during the last four days in the hatcher, from 85° to 87° F. The wet-bulb measurement of humidity cannot be used satisfactorily in the still-air type of incubators. It is advisable to follow the manufacturer's recommendations in regard to humidity.

To provide moisture in small incubators after the first week, either the eggs are sprinkled daily with lukewarm water or a pan filled with water or wet sand is placed below the egg tray. Soaking the floor of the incubator room with water also is helpful. The amount of moisture supplied depends on the climate, the weather, and on the humidity in the incubator room.

The eggs should be turned at least twice daily in small incubators, and three or four times if possible. In agitated-air incubators with automatic turning devices, it pays to turn them three or four times, or more often.

Usually in still-air incubators the supply of fresh air should be small to moderate up to twenty-fourth day; after that large amounts are desirable.

The eggs should be tested on the seventh and twenty-first days.

Care of Ducklings

Brooding

Young ducks can be brooded with hens or artificially. The hens should be confined and the ducklings given free range, as the hens are likely to tire the ducklings by wandering away too far.

With artificial brooders, any type of equipment that is operated successfully with chickens can be used. The ducklings are hardened off in the incubator and are removed to the brooder from 24 to 36 hours after the hatch is completed. Usually from 100 to 150 ducklings are placed in a pen 6 by 12 feet, or in an average-sized colony brooder house. The temperature under the brooder should be about 85° F. for the first week, from 75° to 80° F. the second week, from 70° to 75° F. the third week, and thereafter not more than 70° F. The length of time that artificial heat is needed depends on the season of the year and on weather conditions. The ducklings are kept close to the hover during the first three or four days until they learn where to go

to get warm. The method is similar to that for chickens. The pens may be bedded with 1 or 2 inches of straw or shavings and should be cleaned after about two weeks and as often as necessary thereafter.

On the commercial duck farms on Long Island, the ducklings go directly from the incubator to a permanent brooder house called a *hot house* where the room temperature 5 feet from the floor is kept at about 70° F. for the first week, and five degrees lower (65° F.) the second week. Hover heat is generally supplied by hot water pipes from a central heating system. The brooding temperature is the same as mentioned on page 17.

After about two weeks the ducklings are transferred to a second house or to a warm brooder where the temperature is kept lower, and later to a third and fourth house. The last house does not have heat.

When the weather is good in winter, the ducklings are permitted to run out of doors after they are about two weeks old. They may be allowed out of doors sooner in warm weather. Ducklings should have shade in very warm weather and should be amply protected when it is very cold, especially in wet weather. Good ventilation and sanitation are necessary at all times. As a rule they should not be allowed to swim until they are five or six weeks old.

Some duck growers cover one-half

Figure 8. Well-supported ¾-inch welded-wire floor

Such floors should be high enough above the concrete floor so that droppings can be frequently flushed out with a hose. The growing ducks in the house liked the wire-covered floor better than a straw-covered floor.

or all of the concrete floor of their brooder houses with another floor made of ¾-inch welded wire (figure 8). The wire floor is well supported by wooden 2 by 4's, 15 inches apart one way and 1-inch iron pipe a similar distance apart the other way. The wire floor is 1 foot or more above the concrete floor or high enough so that the concrete floor can be readily flushed out with a hose. The concrete floor should slope slightly so that the water and manure will pass out of the building or down the drains.

Feeding

Ducklings are usually fed within 36 hours after the hatch is completed or as soon as they are placed in the brooder house.

In recent years the use of pellets has greatly simplified the feeding problem. It is only necessary to keep the hoppers filled (figures 4 and 5) and a constant supply of drinking water available.

If pellets are not available, a crumbly wet mash may be fed four or five times daily the first week or two. Later, the number of feedings is reduced to three or four.

Water may be supplied in fountains or various automatic waterers. They should be so arranged that the ducklings can submerge their bills in the water but cannot get

Table 6. Rations for Ducklings

Ingredients	Starting rations for ducklings, 1 to 3 weeks of age*		Growing rations for ducklings from 3 to 9 weeks of age†	
	1	2	1	2
	Pounds	*Pounds*	*Pounds*	*Pounds*
Corn meal	800	475	850	595
Pulverized oats‡	200	200	200	200
Wheat standard middlings‡	300	600	300	500
Wheat flour middlings‡	300	...	300	...
Wheat red dog flour	...	300	...	300
Soybean meal 44 per cent	100	...	100	...
Fish meal (60 per cent protein)	160	160	100	40
Alfalfa meal	40	60	40	100
Corn gluten meal	...	...	...	80
Dried skimmilk	...	80	...	40
Dried corn distillers solubles	...	80	...	80
Brewers' yeast, distillers' solubles, or low lactose dried whey product	60	...	50	...
Steamed bone meal	...	20	...	50
Ground limestone	20	10	30	10
Dicalcium phosphate	10	...	20	...
Riboflavin supplement (BY-21)	0.5	...	0.5	.25
Stabilized vitamin A, 4000 A I.C.U. per gram	2	...	2	...
D-activated animal streol, 1500 D. I.C.U. per gram	1	...	1	2
Iodized salt	6	5	6	5
Manganese sulfate	0.5	1	0.5	1
Niacin	30 grams	...	30 grams	...
Fish liver oil, 2000 A, 400 D I.C.U. per gram	...	10	...	...
Protein, per cent	17.2	20.0	17.6	17.3

*May be fed as 9/64 inch pellets first two or three weeks.

†May be fed as 13/64 inch pellets to follow the starting ration until ducklings are marketed or may be followed by duck fattener for last two weeks before marketing.

‡If it is desirable to use ground whole wheat instead of wheat by-products, add 500 pounds of ground whole wheat and 100 pounds of additional pulverized oats in place of the 600 pounds of wheat middlings.

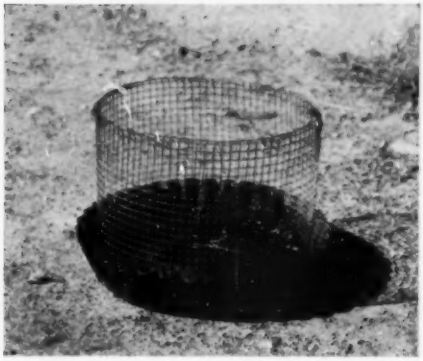

Figure 9. A drinking pan and guard for young ducks

into it to wet their bodies (figures 9 and 10). This permits them to drink and also allows them to cleanse their nostrils by squirting water through them. Any food left over after the ducklings have had their fill should be removed. Sand or grit should be kept before them at all times.

There should be light in the pens so they can see to eat and drink at night.

No grain is fed to ducks grown for market. The following rations are suggested for growing and fattening ducklings.

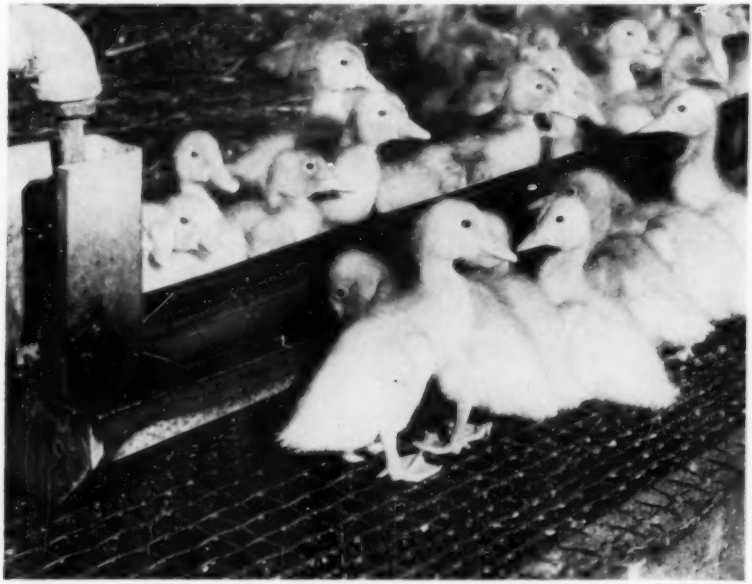

Figure 10. Running water for young ducks

A spring valve automatically controls the flow of running water into this trough for young ducks. The guard prevents the ducks from getting into the trough. The trough rests on a wire-covered platform, and slop from the trough falls through the wire into a drain underneath. This helps to keep the litter dry longer.

Feeding and Management of Young Breeders

FROM the time ducklings are selected as breeders at eight weeks of age until the breeding season begins, every effort should be made to develop and condition them for egg production. Both drakes and ducks should be given a good growing mash, mixed grain, and green food. It is highly desirable to run them on pasture if it is available. About equal parts of mash and grain may be fed. They should complete their growth, pass through a molt, and reach the laying stage in good body flesh. About a month or six weeks before eggs for hatching are desired, a breeding mash should be substituted for the growing mash. The same method should be followed with the laying type of ducks, such as the Indian Runner. Howes (1927–28) reports the following procedure in developing ducks for laying purposes in England:

> After these (the ducks) have been separated from the males (at about eight weeks of age), they should be given their liberty, or placed in extensive runs in fair-sized flocks, and well fed on three meals daily until four months old, when two meals daily will suffice, plus one feeding of grain at night. For the mash use one part bran, three parts sharps (wheat middlings), one part S. G. O. (ground oats), one part maize (yellow corn) meal, and one-half part fish meal. This mixture can be given up to about six weeks before the laying period when the birds should be gradually introduced to the rations and system of feeding intended to be used during the Winter period. A suitable grain ration is equal parts of wheat and kibbled maize (cracked corn) placed in troughs with a small quantity of water.

The rate of growth and the feed consumed by White Pekin ducklings have been reported by Heuser, Scott, Eskew, and Edwards in table 7 as follows:

Pellets

Commercial pellets in place of wet mash are used by most duck growers to start and grow ducklings and for breeder ducks. Pellets reduce labor and handling costs, prevent waste, are more sanitary, do not attract flies so much as does wet mash, and are more convenient.

Table 7. Growth Rate and Feed Consumption of White Pekin Ducklings

Week	Average weight per duckling	Cumulative feed consumption	Feed to produce 1 pound of duck at different ages
	Pounds	*Pounds*	*Pounds*
When hatched	0.14	...	...
1	0.32	0.25	...
2	1.07	1.08	...
3	1.70	3.10	...
4	2.60	5.55	2.13
5	3.50	8.64	2.47
6	4.60	11.67	2.54
7	5.41	14.94	2.76
8	6.25	18.59	2.97
9	6.84	23.25	3.40
Total	...	...	...

Growth appears to be as good, if not better, than when wet mash is fed. Pellets usually are made from regular mash mixtures, and may be slightly more expensive than mash because of the processing.

Batteries for ducks

Ducks may be raised satisfactorily in batteries, also. Mature ducks lay as well in batteries as when they run free on the land.

Marketing

Preparation for market

When to kill

The most economical age to market ducks is usually between seven and one-half and eight and one-half weeks. Feed costs per pound of gain increase rapidly after the eighth week. They should be relatively free of pinfeathers when they are killed. Well-grown White Pekin ducks should weigh from 5½ to 6¼ pounds when they are eight weeks old.

Prior to 1952 ducks were usually sold New York dressed or alive, but during 1952 the demand for ready-to-cook ducks increased greatly. Consequently, it is quite likely that in the future most of the ducks will be sold eviscerated. Live ducks were not quoted on the New York market during 1951 and 1952.

How to kill

Ducks are killed the same as chickens. They may be hung up by the feet in shackles, on a cord, or placed in a funnel arrangement. The funnel is considered by many to be quicker and more satisfactory than the other methods. The jugular vein in the throat at the base of the skull is cut by thrusting a long-bladed knife well back in the roof of the mouth or by cutting across the throat on the outside. Market ducks may have water but no feed on the day they are killed, as feed in their crops hurts both their market value and their keeping quality when sold New York dressed. Time and travel studies were made of the killing and dressing operation on Long Island duck farms in 1948. As a result many changes in methods of dressing ducks have been made.

Scalding and removing the feathers

The feathers are usually removed by scalding or steaming. The water for scalding should be just below the boiling point, usually about 180° F., to prevent discoloring the flesh, or the birds may be scalded at 140° F for three minutes. The ducks should be scalded and picked just as soon as they are through bleeding. If a large number of ducks are to be dressed, a scalding vat should be provided with some means of keeping the water at a uniform temperature. If only a few ducks are to be dressed at a time, a wash boiler serves the purpose. An ordinary metal pail is too small. In scalding, the bird is usually held by the head and feet and soused into the water long enough for the water and steam to penetrate into

Table 8. Average Market Prices for New York Dressed Ducks per Pound for Two Years in New York City, January 1, 1951 to December 31, 1952*

Month	No. 1 in barrels		No. 1 in crates		Boxed	
	Fresh	Frozen	Fresh	Frozen	Fresh	Quick frozen
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
January	....	0.330	....	0.345	....	0.347
February	....	0.325	....	0.336	....	0.341
March	....	0.317	....	0.332	....	0.337
April	0.303	0.309	0.310	....	....	0.326
May	0.291	0.302	0.300	0.320	....	0.320
June	0.293	0.302	0.300	0.320	....	0.320
July	0.295	0.303	0.301	0.322	....	0.321
August	0.290	0.305	0.31†	0.317	0.295†	0.325
September	0.300	0.309	0.31†	0.320	0.303†	0.328
October	0.311	0.316	0.322†	0.323	0.315†	0.333
November	....	0.317	....	0.327	....	0.335
December	....	0.318	....	0.332	....	0.341

*Data from Producers' Price Current.
†One year's quotations.

the base of the feathers and to release them. Scalding is enough when breast or body feathers can be removed easily. If the head and feet are kept above the surface of the water during scalding, the birds retain the bright yellow color in these parts and make a much better appearance on the market.

The breast and body feathers are picked first, working toward the tail. In doing this, the bird is held on the lap of the picker or on a table. The long tail feathers are usually left in, the wings are picked to the first joint, and the neck halfway to the head. The removal of the down, which is the most difficult part of picking a duck, is accomplished by gently rubbing with the hands; but care must be taken not to remove the skin. Sometimes the remaining down is removed by singeing with a blow torch. Long pin feathers are removed by grasping them between the thumb and a dull knife.

To pick ducks quickly requires considerable experience. On the large duck farms, an expert picker picks 75 or more ducks in a day.

Mechanical pluckers

Most of the large duck farms now use picking machines. This speeds up the picking job. Usually, to prevent removal of scurf skin, the ducks are slack-scalded at a temperature of 140° F. for about 3 minutes until the feathers pull readily. They are then rough-picked on the machine and finished by hand. A different type of picker is reported in use on one New England duck farm where ducks are dry-picked. This picker is recommended only for dry-picking. After the ducks are killed and bled, most of the feathers are removed by the machine. The remaining down and feathers are then removed by hand, by scalding, or by singeing with a blow torch.

The wax method of picking

When the wax method is used, the birds should be scalded at a temperature of 140° F. for 3 minutes or long enough to readily pull the feathers. After rough-picking the body feathers and removing the wing and tail feathers, the skin and remaining down and feathers should be dried with a fan before waxing. The ducks are then dipped into the melted wax at a temperature of 155° to 165° F., holding each bird by the head and feet. The bird is moved around a little in the wax to help the wax penetrate to the skin. Then the bird is dipped into cool water and again into the wax and, finally, plunged into cold water to chill and harden the wax moderately. The wax coating may then be removed, first by breaking the covering on the legs and breast, and then rolling the wax from the rest of the carcass. In this way the feathers, down, and pins are removed.

For best results, a special wax mixture is needed. This may be obtained from certain commercial manufacturers. Much of the wax used may be reclaimed by melting. A thermostatically controlled electric unit is most satisfactory for melting the wax and maintaining the proper temperature.

Chilling and packing for shipment

As soon as the ducks are picked, they are "plumped" briefly in water at 180° F. This is done mostly when the ducks are scalded at 140° F. They are then washed and cooled in slush ice water for an hour or two to remove the animal heat. They are then ready to be packed for market unless they are sold eviscerated.

On Long Island, where large numbers are being handled, dressed ducks for shipment are generally packed on their sides, or breast down, between layers of ice, in barrels or boxes. Enough room is allowed at the top of each barrel or box for a layer or header of cracked ice.

It is a good plan to grade the dressed ducks according to size and quality before they are packed.

Marketing duck eggs

The market for duck eggs in New York City is not so extensive as that for hen eggs. Duck eggs sell best on the New York market at Easter time and during the fall and early winter months, although in recent years not enough eggs come on the market to justify a quotation. With the exception of Easter time, they usually sell for several cents less than the best quality of hen eggs.

Since duck eggs are larger than hen eggs, special egg cases and fillers are needed.

Market duck eggs, to maintain the quality until sold, should be placed as soon as gathered in a damp, cool place where the temperature ranges from 50° to 60° F.

For the most profit from a laying flock the ducks must have been hatched at the right time and prop-

erly managed during their growing period. Good fall and winter egg production is just as important with ducks as with hens, and a good winter lay cannot be obtained from late-hatched stock. April- and May-hatched ducks are probably the best winter egg producers. Probably it is most advantageous to market all birds each year, except those that may be kept as breeders, late the following spring, or in early summer, before they begin to molt.

Sale of duck feathers

The sale of feathers is an important item on a large duck farm and often pays for the picking. Six well-grown Pekin ducks yield about 1 pound of dry feathers.

At present it is the custom on the commercial duck farms on Long Island to gather all of the wet feathers at the close of a day's killing for immediate delivery to a central feather-processing factory. Here they are dried, cleaned, and graded for the trade. The price paid to duck farmers for dry, white, duck feathers (bird run without quills) varies greatly, depending on the supply and on market demand. The down, or under-coating of the duck, and the soft body feathers are most valuable. The quills do not have much value.

Feathers from dry-picked ducks are more valuable because their quality is not impaired by scalding. Practically all the growers on the large duck farms prefer to scald their ducks.

On farms outside the Long Island area, where feathers are saved for sale, the coarser feathers should be kept separate from the finer body feathers. Wet feathers spoil rapidly, and should, therefore, be spread immediately in a thin layer, not more than ¼ to ½ inch deep, in the loft of a building where it is warm and airy. They should be shaken and re-spread daily. The feathers may also be placed in burlap sacks and hung in an airy place. The sacks should never be filled more than half full and the feathers should be shook frequently in the bags.

Feathers to be dried on the farm and shipped to market should be washed with soap and a little ammonia, rinsed thoroughly, and finally run through a wringer before storing them to dry. Feathers should be thoroughly dry before they are shipped to market.

Some growers prefer to sell the feathers wet. If they live near a feather processing plant so that the feathers can be delivered immediately to the factory, it makes an easy way to market them. If the wet feathers are held for more than a day, a preservative should be used to prevent spoilage. This can be done as follows:[1] For each 15 pounds of wet feathers, thoroughly mix 15 pounds of common salt and 1 pint of commercial concentrated

[1]From *Feathers from Domestic and Wild Fowl*, By John L. Hardy and Thora M. Plitt Hardy. U. S. Dept. Agr. Circ. 803.

hydrochloric acid in 30 gallons of water. Let the feathers soak in the solution over night, then drain, pass them through a wringer, and they are ready to ship to the processing plant in gunny sacks.

Feathers amount to about 4 per cent of the total sales on Long Island duck farms.

Manure

DUCK manure is a valuable source of organic matter for the land. Average analyses show that 1 ton of duck manure contains about 22 pounds of nitrogen, 29 pounds of phosphoric acid, and 10 pounds of potash. Duck manure, therefore, is about twice as rich in nitrogen, six times as rich in phosphorus, and has as much potash as average farm manure.[2]

Duck Troubles Due to Management

A COMMON cause of the condition known as *staggers* is due to a temporary shortage of drinking water. The birds feed before the water supply is replenished or at the same time. Such birds usually die in a short time. Cool water from a well, if given to ducklings when overheated, may also be fatal. Such water should stand in the sun until the chill is off before it is placed in the drinking vessels.

A regular supply of drinking water is important.

Ducklings cannot stand the sun after eating; if natural shade is not furnished by trees, some other shelter should be provided.

Feather eating or quill pulling is a habit which frequently gives trouble in the larger flocks. This is usually remedied by giving the ducks more room or access to water.

During heavy laying, some birds may become ruptured much the same as hens. If cannabalism starts as a result of this, the control is the same as for chickens.

Ducks as a rule are rather vigorous and are less subject to disease than are hens. When disease does occur, it is most likely to be the result of insanitary surroundings and faulty management, or of inherent weakness due to inbreeding.

Breeds of Ducks

EVIDENCE indicates that all of our breeds of domestic ducks have descended from two wild species: the Mallard, or wild duck, which is a native of all parts of the Northern Hemisphere; and the Muscovy, a native of South America. A list of the domestic breeds and varieties of ducks, with their weights as given in *The American Standard of Perfection*, is given in table 9. The color and size of the eggs are also given, but the data are taken from a different source.

The different breeds of ducks shown in table 9 are usually

[2] From *Soil and Pasture Management for Long Island*, p. 18–19. By A. F. Gustafson and D. B. Johnstone-Wallace. Cornell Univ. Agr. Exp. Sta. Bul. 755. 1941.

Table 9. Breeds and Varieties of Ducks

Breed	Variety	Standard weight				Weight of eggs	Color of eggs
		Drake		Duck			
		Old	Young	Old	Young		
		Pounds				*Ounces*	
Pekin	White	9	8	8	7	40	White or bluish green tint
Aylesbury	White	9	8	8	7	40	White or greenish white
Rouen	Colored	9	8	8	7	40 to 45	Pale green or bluish green or white
Cayuga	Black	8	7	7	6	35 to 40	Black to bluish green
Call*	Gray					16 to 24	White to green
East India*	Black					16 to 24	Black to bluish green
Muscovy	Colored	10	8	7	6	48 to 52	White to greenish cream
	White	10	8	7	6	48 to 52	
Swedish	Blue	8	6½	7	5½	.....	White or pale blue
Buff	Buff	8	7	7	6	.....	White
Crested	White	7	6	6	5	.....	White to green
	Fawn and white	4½	4	4	3½	32	White and creamy white
Runner	White	4½	4	4	3½	32	White, creamy white
	Penciled	4½	4	4	3½	32	White, creamy white
Khaki Campbell†	Brown or warm khaki color	4½	4	4	.....	31	White
Mallard†	Colored	½ to 3	.....	1¼ to 2½	.....	26 to 32	Bluish green, sometimes mottled

*There is no standard weight for these breeds, but the drakes weigh from 2½ to 3 pounds; ducks from 2 to 2½ pounds.
†Not given in *American Standard of Perfection*.

grouped, according to the purpose for which they are best adapted, into three divisions: the meat, or general-purpose class, the egg class, and the ornamental class.

The meat class

The meat breeds include Pekin, Muscovy, Rouen, Aylesbury, Cayuga, Buff, and Swedish. The Pekin, Muscovy, and Rouen are the most popular breeds of this group in this State.

The Pekin

The Pekin (figure 11) is practically the only breed kept on the large farms on Long Island and in other parts of the State where ducks are raised for meat purposes. This breed of ducks originated in China and was first introduced into this country about 1873. They became popular as meat ducks immediately and have continued to be favorites up to the present time because of their all-round good qualities. They are remarkably hardy, good layers for this type of duck, rapid growers, uniformly large in size, and, being white feathered with a yellow skin, they make a good appearance when dressed for market. Although timid and easily frightened, they are docile and easily confined by low fences and are well suited for the large meat-duck farms, as well as for the small flocks on general farms.

The Rouen

The Rouen duck (figure 12) derives its name from the city of Rouen in northern France. This breed comes directly from the wild Mallard, which it resembles closely

in color of plumage. It is similar in size, shape, and type to the Pekin. The males differ in color from the females. The drake has a green head and upper part of the neck, with a wide white ring around the lower part of the neck. The eyes are dark brown. The back is gray mixed with green near the neck, shading into a lustrous green near the tail. The lower part of the body is a blue French gray, the breast is deep claret, and the tail is slate-black. The flight feathers of the wings are slate-black with a brown tinge: the wings have a wide, pur-

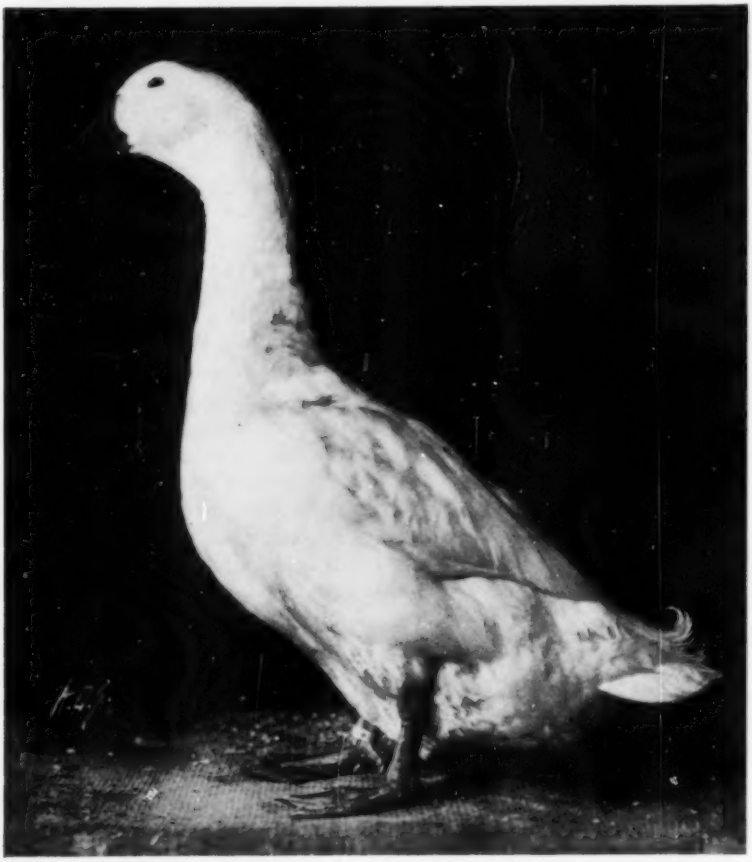

Figure 11. A white Pekin drake

ple bar with narrow, white bars on each side of the purple, which are exposed when the wing is folded. The shanks and toes are an orange or orange-brown color.

The duck is barred on the wings much the same as the drake but the body plumage is brown with penciling in all sections.

Rouen ducks have handsome markings which makes them fine show birds, but they are not so suitable for market purposes as are the Pekin or Aylesbury because they do not mature so quickly and have dark-colored pin feathers. The quality of their flesh, however, is very good. They are good layers. Rouen ducks, therefore, are not so desirable for the larger duck farms, but are best adapted for the fancier or the general farmer.

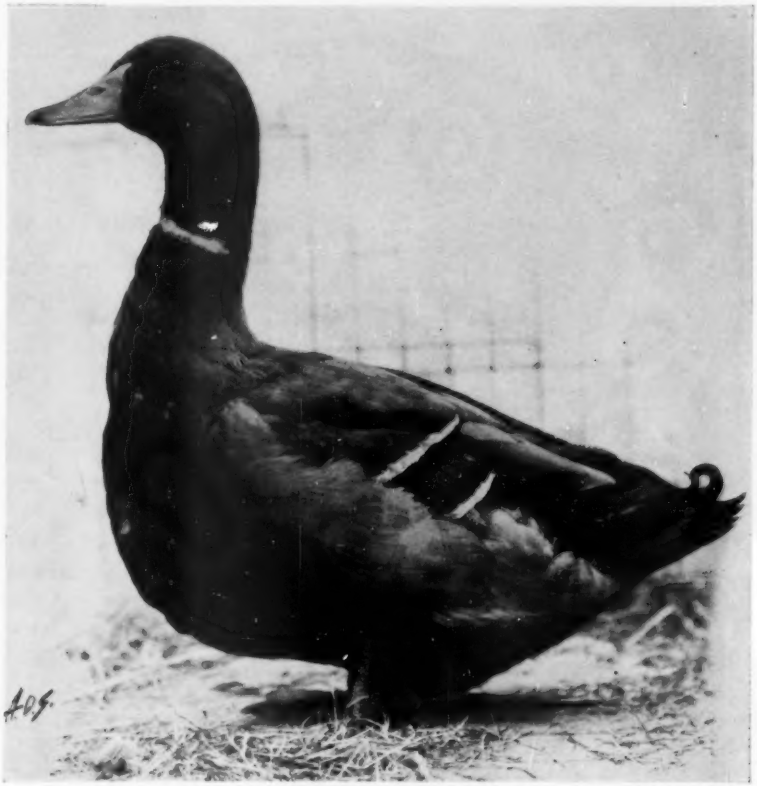

Figure 12. A Rouen drake

Figure 13. A Rouen duck

The Aylesbury

The Aylesbury duck is a native of England where it is more popular than the Pekin. It is similar to the Pekin in size but differs from it in type and color of skin. It carries its body more horizontally and the skin is pinkish white. Before the introduction of the Pekin, Aylesbury was the favored breed on commercial duck farms in this country, but later lost favor because of its white skin and the fact that it was less vigorous than the Pekin.

The Muscovy

The Muscovy is a native of South America where it is found in a wild state. The two standard varieties of Muscovy ducks are the white and the colored (figures 14 and 15). In

Figure 14. White Muscovy ducks

Figure 15. A colored Muscovy drake

appearance this duck differs from the other domestic breeds in that its head and face are partly bare, with red, rough skin. The chief peculiarity is a bright red knob of flesh, like a cherry, on the front of the head. Another peculiarity of the Muscovy, distinguishing it from other breeds, is its swan-like hiss. Muscovy is the only breed of the domestic ducks that flies.

When Muscovies are mated to other breeds of domestic ducks, they produce hybrids which do not breed.

In body the Muscovy is long and broad, but lacks the depth of body and length of keel of the Pekin. The neck and legs are of medium length and fine in bone. The Muscovy is one of the two breeds of ducks with a white skin. The male is about one-third larger than the female.

Muscovy ducks, although hardy and vigorous, are not so well adapted for meat purposes as are Pekins. They vary in size, are poor layers, and must be killed at the proper age or the flesh is tough and of poor flavor. They are good fliers but can be kept in confinement easily because they are not inclined to wander. Their savage disposition makes it difficult to keep them with other poultry. Muscovy ducks are good foragers (when given the opportunity) and require little care; consequently, they are probably best adapted to general-farm conditions.

It is generally thought that Muscovy duck eggs cannot be hatched successfully in incubators. If, however, the eggs are placed under hens for the first week, and then transferred to incubators for the remainder of the hatching period, good hatches may be obtained.

It is suggested that eggs set in either forced-draft or still air incubators should be turned completely over (180° F.) at each turning and that the eggs should be dipped in water at a temperature of 100° F. for one-half minute or sprayed with luke-warm water in the incubator from a hose twice a week throughout the incubating period.

The best age to market Muscovy ducks is while they are "in the down," or before they have taken on their adult plumage. This is usually the period between thirteen and sixteen weeks of age.

Apparently there is a call for Muscovy ducks on the New York market, as they are the only breed listed in the market quotations. They usually sell alive, however, for several cents less than other near-by ducks.

Miscellaneous meat breeds

The Cayuga, Buff, and Swedish ducks are not commonly kept on New York farms.

The egg-laying class

The Indian Runner

The Runner ducks are best known for egg production in this State. The three standard varieties

of Indian Runner ducks are white (figure 16), Fawn and white (figure 17), and penciled. These are called *Indian Runners* because the original stock came from the East Indies. After their introduction into Europe they were crossed with the Mallard and other breeds.

The Indian Runners are much smaller than the meat type of ducks and, aside from their exhibition value, are best adapted for the pro-

Figure 16. A white Indian Runner drake

duction of eggs. They are very hardy and, when properly bred and cared for, there is considerably less mortality in a flock of laying ducks than in a flock of laying hens. As previously stated, however, it costs more to grow and keep ducks than hens, and the market for the eggs is rather limited.

The Khaki Campbell

More recently a new type of laying duck similar to the Indian Runners has been developed in

Figure 17. A fawn Indian Runner drake

England by crossing the Indian Runner with the Rouen, Mallard, and others. The name of this new breed or variety is the *Khaki Campbell*. The breed gets its name from the man who originated it, a Mr. Campbell, in Gloucestershire, England. The word *Khaki* was added to the name because the sandy plumage of the ducks was similar in color to the khaki garb of the British soldiers. Each feather has a darker lacing on the outer edge. The female is of this color all over, but the male has a bronze green head and is somewhat like the Rouen. Khaki Campbell's are exceptionally good egg producers and have higher records at some of the English egg-laying trials (tables 2 and 3, page 5) than any other breeds of ducks. As yet they are not commonly kept in this State but are deserving of more consideration.

The ornamental class

The Call, Crested, and East India ducks, together with many other small, wild ducks, are kept almost entirely for exhibition or ornamental purposes.

The Cooking Quality of Duck Eggs as Compared With That of Hen Eggs

A LIMITED number of cooking and baking tests were made at the New York State College of Home Economics, at Cornell University, to compare the cooking quality of duck eggs with that of hen eggs.[3] Four persons were asked to judge and report their reaction to both kinds of eggs.

The yolks of the duck eggs were reported to have a deeper yellow color but the whites were translucent and more watery than the hen eggs.

In comparing a soft-cooked duck egg with a soft-cooked hen egg, there was little difference in texture and no other serious objections, but, in general, the judges seemed to feel that the hen egg was more desirable in flavor.

For scrambling, the judges preferred the duck eggs because of the richer flavor and the yellow color of the yolks.

Plain cake made with duck eggs was, with one exception, preferred by the judges. Its appearance was more desirable. It was light with a velvety texture and an even fine grain. The flavor was richer but, since only one test was made, these results may not always be true. The judges preferred duck eggs for sponge cake, but in two trials with angel cake and meringue they were not so good as hen eggs. The whites of the ducks eggs did not beat up to give as large a volume as the whites of hen eggs. They required more beating and did not stand up so well.

[3]Unreported work done by La Verne Haught.

For custard sauce, two of the judges noted a strong, eggy flavor. It was suggested that a small amount of vanilla would disguise this if objectionable.

When prune whip was made with the whites of duck eggs, the results were satisfactory. The duck egg whites beat up slowly but with a very fine air cell which give the product a fine texture that stood up well on cooling.

The data given in table 10 show that duck eggs are rather similar to hen eggs in composition.

The conclusions from these limited and preliminary trials were:

1. Duck eggs can usually be successfully substituted for hen eggs, particularly, when they are cooked in the shell, are fried, poached or, scrambled.

2. The yolks of the duck eggs were just about as satisfactory for all purposes as were the yolks of hen eggs.

3. The greatest variation was in the whites. The whites of duck eggs beat up slowly and did not give so large a volume or stand up so well as did the white from hen eggs. For angel-food cakes and meringues, duck eggs were not satisfactory.

4. The stronger flavor and color of the yolk of the duck eggs proved to be desirable features when combined with other foods.

5. One duck egg had one tablespoonful more white and one-fourth tablespoonful more yolk than a hen egg.

Table 10. Average Composition of Duck Eggs as Compared with the Eggs from Other Poultry

Kind of eggs	Water	Protein	Fat	Ash	Fuel value per pound
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Calories*
Duck:					
Whole egg, edible portion	70.5	13.3	14.5	1.0	835
White	87.0	11.1	0.03	0.8	203
Yolk	45.8	16.8	36.2	1.2	1,683
Hen:					
Whole egg, edible portion	73.7	13.0	10.5	1.0	672
White	86.2	12.3	0.2	0.6	231
Yolk	49.5	15.7	33.3	1.1	1,643
Goose:					
Whole egg, edible portion	69.5	13.8	14.4	1.0	829
White	86.3	11.6	0.02	0.8	211
Yolk	44.1	17.3	36.2	1.3	1,793
Turkey:					
Whole egg, edible portion	73.7	13.4	11.2	0.9	700
White	86.7	11.5	0.03	0.8	210
Yolk	48.3	17.4	32.9	1.2	1,660
Guinea fowl:					
Whole egg, edible portion	72.8	13.5	12.0	0.9	735
White	86.6	11.6	0.03	0.8	212
Yolk	49.7	16.7	31.8	1.2	1,598

Comparison of Duck and Chicken Meat

DUCK meat has much more energy value per pound than does chicken meat because it usually carries more than twice as much fat as is found in young chicken. In chicken the light and dark meat have about the same energy value per pound, while in duck the leg and second joint have a higher energy value than the breast and are almost equal to pork chop in this respect. Duck meat compares favorably with chicken meat in vitamin content.

Table 11. Average Composition of Duck Meat as Compared with Chicken and Other Meats*

Food	Nature of sample and refuse	Refuse	Water	Protein	Fat	Ash	Fuel value	
							Per 100 grams	Per pound
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Calories*	*Calories*
Duck domesticated Fresh Total edible	Edible portion, flesh, skin, giblets and most of fat		54.3	16.0	28.6	1.0	321	1,470
	As purchased dressed	36	34.8	10.2	18.3	0.6	206	930
	As purchased drawn	16	45.6	13.4	24.0	0.8	270	1,220
Flesh only	Edible portion		68.8	21.4	8.2	1.2	159	720
Chicken Fresh Fryers 2½–3½ pounds live weight 14 to 20 weeks old Total edible	Edible portion, flesh, fat, skin and giblets		67.6	20.0	11.0	1.0	179	810
	As purchased dressed	40	40.6	12.0	6.6	0.6	107	490
	As purchased drawn	22	52.7	15.6	8.6	0.8	140	630
Flesh only	Edible portion		73.4	20.6	4.8	1.1	126	570
Beef Fresh, round, fat	Edible portion 84 per cent lean		63.0	18.7	17.0	0.9	228	1,030
	As purchased 76 per cent lean	10	57.0	16.8	15.0	0.8	205	930
Lamb Fresh, leg, fat	Edible portion 78 per cent lean		59.8	16.7	22.4	0.8	268	1,220
	As purchased 65 per cent lean	16	50.2	14.0	18.8	0.7	225	1,020
Pork Fresh, loin, fat	Edible portion		52.0	14.8	32.0	0.8	347	1,570
	As purchased	16	44.0	12.4	27.0	0.7	292	1,320

*From *Proximate Composition of American Food Materials*, by Charlotte Chatfield and Georgian Adams. U. S. Agr. Dept. Circ. 549. 1940.

Table 12. Relationship of Percentage of Edible Meat to New York Dressed Weight, 18 Long Island Ducks, 1949

Duck number	N. Y. dressed weight		Drawn weight plus giblets	Giblets	Inedible offal and viscera	Skin, fat and edible flesh	Bone	Skin and fat	Lean meat
	Ounces	*Per cent*	*Ounces*	*Per cent of New York dressed weight*					
1	94.50	100	73	7	27	45	21	24	21
2	96.50	100	73	7	27	41	25	21	20
3	88.25	100	71	7	29	41	23	22	19
4	102.50	100	72	8	28	42	22	25	17
5	88.50	100	74	6	26	51	17	28	23
6	95.25	100	72	8	28	49	15	31	18
7	85.75	100	76	8	24	49	19	30	19
8	87.50	100	74	8	26	43	23	24	16
9	91.50	100	72	8	28	42	22	26	16
10	92.50	100	72	8	28	40	24	24	16
11	85.25	100	74	7	26	44	23	25	19
12	84.00	100	73	8	27	39	26	21	18
13	96.00	100	72	7	29	39	26	19	20
14	79.25	100	76	8	24	44	24	22	22
15	87.00	100	73	7	27	41	25	22	19
16	84.50	100	75	7	25	43	25	24	19
17	87.75	100	72	7	28	43	22	22	21
18	87.00	100	71	7	29	44	20	25	19
Average	89.64	100	72	7	28	43	22	24	19

*From *Marketing of Long Island Ducks*. By Neil A. McLeod. Cornell Univ. Agr. Exp. Sta., Dept. Agr. Eco. A.E. Bul. 726. 1950.

Yield of Edible Meat From a Duck

To determine the edible meat on a duck, McLeod[4] purchased 18 New York dressed ducks, removed the meat, and weighed it. The procedure was the following:

(1) Frozen, New York dressed, Long Island ducks were purchased in boxes from a retail store. (2) Each duck was weighed to the nearest quarter ounce. (3) The neck was severed at the third joint, weighed, and discarded. (4) The legs were severed at the knee and the shank and feet weighed and discarded. (5) The wing tips were severed, weighed, and discarded. (6) The viscera was removed, weighed, and discarded, except for the heart, gizzard, and liver. (7) The eviscerated bird was weighed. (8) Bones were separated from the flesh. (9) Skin and edible flesh were weighed. (10) Bones were weighed. (11) Giblets were weighed. (12) Skin and fat lying between the skin and lean meat were separated from the lean meat. (13) Skin and fat were weighed. (14) Lean meat was weighed.

The skin, fat, and edible flesh of ducks accounted for 43 per cent of the New York dressed weight (table 12). The lean meat of the edible portion comprises only 19 per cent of the New York dressed weight. The comparable percentages for chickens is 43.8 per cent and 34.4

[4]McLeod, A. Neil. *Marketing of Long Island Ducks*, Cornell Univ. Expt. Sta., A. E. Bul. 726. 1950.

per cent[5]; for turkeys 57.6 per cent and 48.2 per cent.[6]

Diseases of Ducks

By Ellsworth Dougherty, III[7]

The duck has frequently been described as resistant and hardy. This is true. With commercialization of duck farming, however, the duckling is reared under unnatural conditions and is subject to a variety of diseases too numerous to discuss here. The grower must, however, have some idea of what to expect in the way of disease and to know the importance of an accurate laboratory diagnosis. Diagnostic laboratories of the New York State Veterinary College at Eastport and Farmingdale, Long Island, are glad to help duck growers in that commercial duck-growing area. There are other regional laboratories in up-state New York.

It must be remembered that a clean duck farm is not an impossibility. Many such farms exist. The extra effort necessary to keep ducks clean will be repaid by increased growth and by a reduced incidence of certain of the diseases.

The following discussion is arranged according to the age group in which the disease is most often encountered.

Paratyphoid (Keel)

This first cousin of pullorum diseases in chickens is an infectious disease of young ducklings, turkeys, and other birds caused by a bacterium known as *Salmonella typhimurium*, and to a lesser extent other salmonellas. The average mortality is low (less than 10 per cent) on Long Island. Poor management certainly increases the mortality from this disease.

Symptoms

The term *Keel*, stemming from the observation that the duck keels over, is misleading. Indeed, very often the ducklings die slowly, becoming dehydrated. They may gasp for air, or tremble as though chilled.

Lesions. The lesions commonly seen are small white spots on the liver, cheesy plugs in the blind gut, and a thickening of the wall of the large gut. Urates may accumulate in the kidneys and ureters, and the ducklings are usually emaciated.

Prevention and treatment

The proverbial ounce of prevention is worth many pounds of cure, and the best preventive measure to

[5]Byerly, T. C. and Gwin, J. M. Unpublished data, University of Maryland, 1940.

[6]Marsden, S. J. and Martin, J. H. *Turkey Management*, Third Edition, The Interstate, Danville, Illinois, page 568.

Headly, F. B. *Relation of Size of Turkeys to: Economy of Production, Edible Meat in Carcass, Weights of Parts of Carcass.* University of Nevada Agr. Exp. Sta. Bul. 180. Reno, Nevada, 1948.

[7]Dr. Dougherty is at the Duck Disease Research Laboratory at Eastport, Long Island, a Branch of the New York State Veterinary College, Ithaca, New York. Financial assistance for the laboratory is rendered in part by the Long Island Duck Growers Marketing Cooperative Association.

date is the fumigation of the eggs during early incubation and of the hatching unit between hatches. Fumigation with potassium permanganate and formalin is the recommended procedure. The potassium permanganate crystals should be used at the rate of ½ ounce (weighed) and 1 ounce of formalin (measured) to every 80 cubic feet of incubator or hatcher space. The crystals should be placed in an earthenware vessel with a capacity of 1 pint for each ounce of formalin required. The vessel is then placed on the floor of the machine and the formalin poured over the crystals. The doors and vents should be closed for 10 minutes. One should avoid inhaling the fumes and handle the formalin with care, for it will harden the skin.

The above procedure should be followed from three to five days after each lot of eggs is set, and between hatches after the hatcher has been cleaned. One must not fumigate while eggs are hatching.

Even though there is some infection of the ovary, the above recommendation is made on the following basis: The most common route of infection is through the egg shell. Karlshøj and Szabo found that penetration of the shell takes place about the eighth day of incubation; thus fumigation of the eggs early in incubation should be practiced in an effort to prevent entrance of the bacteria into the egg. It is best not to wash hatching eggs prior to setting.

Treatment of paratyphoid consists of rigid culling and of sulfonamide therapy in the drinking water (if the mortality increases from day to day). The ducks should be kept on clean bedding, since *Salmonella typhimurium* may be found in the feces of affected ducks and can be transmitted by ingestion of infected material. Josland has shown that *Salmonella typhimurium* remained alive up to 28 weeks in feces, thus the importance of thorough cleaning and disinfecting the brooder house after removal of an infected flock.

Duck Virus Hepatitis (Baby Duck Disease)

Virus hepatitis, a highly fatal virus disease of young ducklings, is characterized by its rapid course in a flock, a very high mortality, and the way in which the dead and dying birds are found with their heads thrown back against the spine.

The disease was described by Levine and Fabricant in the White Pekin ducks of Long Island in January of 1950. The virus has since been isolated from wild ducks (Mallards) on Long Island and from White Pekin ducks in Massachusetts, western New York and Illinois.

Symptoms

Losses up to 90 per cent are common and occur within two days of the first mortality. The biggest ducklings die first and without warning. Individuals are dead 30

minutes after showing the first signs. They lie on their sides with their heads thrown back. The feet may paddle as though they were swimming and the beak is often purple in color.

Lesions. Lesions consist of small hemorrhages on the liver and mottling of the spleen and kidneys.

Prevention and treatment

Treatment with serum from ducks which have recovered from the disease was tried successfully by Levine and Fabricant and has since found wide use in the industry. A serum bank of several million milliliters is maintained on Long Island.

Geese, muscovies, chickens, turkeys, and game birds reared in contact with infected ducks have failed to show any evidence of the disease.

Aspergillosis (Brooder Pneumonia)

Aspergillosis is a respiratory disease of young ducklings caused by a fungus *(Apergillus fumigatus).* The disease is also known as *brooder pneumonia* and *"gaps."*

Symptoms

The first two weeks of life is the period of greatest susceptibility. The fungus has, however, been found growing in the air sacs of ducks of all ages, including breeders.

Affected birds gasp for air with the head and neck extended. Many become weak and actually die of thirst.

Lesions. Cheesy nodules varying in size from pin-point to 1/8 inch in diameter are found in the lungs and air sacs. In older birds the filamentous type of growth, similar to that seen on moldy bread, may be present in the air sacs.

Prevention and treatment

Moldy litter should never be used for young ducklings. Moldy feed should also be avoided. Every effort should be made to keep the area around the water fountains dry through the use of wire platforms and drains.

Treatment of individual birds is unsatisfactory. The litter in affected pens should be removed or covered with fresh litter.

Anatipestifer Infection ("New Duck Disease")

In 1932 anatipestifer infection was described by Hendrickson and Hilbert, who assigned the name *Pfeifferella anatipestifer* to the causative organism.

Although other diseases cause higher losses in individual flocks, "New Duck Disease" has become so wide-spread and is so resistant to known therapeutic measures that it is today the most important disease problem confronting the duck industry.

Symptoms

The symptoms of "New Duck" are coughing, staggering, and loss of equilibrium. Frequently the ducks lie on their sides or backs and

paddle their feet. Death is often due to water starvation rather than to the infection. Loose green and white droppings are a common finding in a pen of affected ducks. Losses up to 75 per cent have been recorded.

Lesions. The lesions are a characteristic cream-colored gelatinous membrane over the heart and liver. This membrane may be 1/8 inch or more thick. The air sacs may contain a yellow cheesy substance. The liver and spleen are enlarged, and subcapsular hemorrhages may be present on the liver.

Diagnosis at the Duck Disease Research Laboratory is made on the basis of history, lesions, and the elimination of fowl cholera by cultures.

Prevention and treatment

No satisfactory treatment is available. Sulfa drugs have been widely used with varying results. Two pounds of sulfa-quinoxaline per ton is the recommended level. The ducks should be starved for four to six hours and the medicated feed given for the remainder of a 24-hour period. This treatment may be repeated if necessary. Early in an outbreak of "new duck disease," a control flock of 10 per cent or more should be left untreated to establish whether or not the drug is effective.

Fowl Cholera (Pasteurellosis)

Fowl cholera is an infectious bacterial disease of ducks and other birds caused by *Pasteurella multocida.* The host range for this disease is very wide. Chickens, turkeys, geese, and many other species are susceptible.

Symptoms

Losses from fowl cholera are seldom seen in ducks under four weeks of age. The affected ducks are hot to the touch, the skin is usually red, and the healthy birds in the flock frequently pick the feathers from the sick and dying ducks. Light green droppings are usually found in a pen of affected ducks. Swollen hock joints may be seen in flocks following an outbreak of fowl cholera.

Lesions. Hemorrhages are usually found on the heart. Cheesy masses may be seen in the air sacs and on the heart. The liver and spleen are enlarged. Small areas of dead tissue (white spots) may be found on the liver. The blood vessels of the intestines and other organs are engorged with blood. The skeletal muscles are darker than normal.

Diagnosis must be made by identification of the causative organism, since the lesions of fowl cholera and "New Duck Disease" are easily confused.

Prevention and treatment

Fresh drinking water and clean quarters appear to be of some importance in the control of cholera in ducks.

Chemically killed and heat-killed

cultures of *Pasteurella multocida* have been used successfully for the control of fowl cholera. Two doses of 1 to 2 milliliters of duck origin bacterin (dose determined by the size of the duck) a week apart are inoculated at least one week prior to an anticipated outbreak. Recent experiments indicate that an egg-embryo vaccine will be even more effective than broth bacterins for the control of fowl cholera in ducks.

Treatment with sulfonamides is of some value. Not all outbreaks, however, respond to this type therapy, and sulfa drugs should not be used on breeder flocks in production. Antibiotics in the feed have not afforded protection.

Sick and dead ducks should be incinerated or buried, since Hendrickson and Hilbert found that the cholera organism could survive for long periods of time in carcasses.

Botulism
(Limberneck)

A poisoning caused by the toxin elaborated in dead animal and vegetable matter by a species of bacteria known as *Clostridium botulinum*. When the toxin is consumed, the ducks develop a paralysis of the neck muscles (limber neck) and the feathers become loose.

Diagnosis is made by demonstration of the toxin in the blood of sick ducks. This is accomplished by inoculating the suspected serum into immune and non-immune mice.

Pellet feeding, maintaining a constant water level, and frequent removal of dead animals aid in the control. Treatment of the birds with antitoxin is recommended only when the individual value of the bird is high.

Coccidiosis

Coccidiosis is a minor problem in ducks. Outbreaks with losses up to 24 per cent have been reported, but the disease has not spread to other flocks on the affected farms.

External parasites

The duck louse *(Anatoecus dentatus)* is frequently found in breeding flocks on Long Island. The louse is found on the head and control consists of dusting 5 per cent DDT under the feathers on the head of the affected ducks at the time of selecting breeders.

Poisonings

Ammonia Gas

A keratoconjunctivitis and inflamation of the mucous membranes of the nose and throat resulting from ammonia fumes is common in ducks. Frequently removal of the litter and good ventilation are the best control measures.

Salt

As little as 2 per cent sodium chloride in the feed, 4000 parts per million in the drinking water, or any combination, appears to be the toxic level. Toxic levels depress growth in ducklings and lower fer-

tility and hatchability in breeder ducks.

Nutritional deficiencies

Vitamin-A deficiency characterized by severe embryo losses and high mortality in ducklings hatched from the eggs of ducks being fed rancid pellets has been reported by Peterson and Morill. Most of the affected ducks had pasty eyes.

Scott and Heuser reported that a niacin deficiency caused bowed legs in ducks. Ten milligrams of added niacin per pound of feed prevented the development of bowed legs.

Foreign bodies

Ducks are known for their unusual habit of eating shiny objects. Nails, wire, screws, and other objects which might penetrate the gizzard or intestine if consumed, should be removed from pens in which ducks are to be kept. Special care must be exercised when making repairs on duck buildings to see that nails are not lost in the bedding or yards.

Miscellaneous diseases

Breeder flocks may have such conditions as prolapse of the oviduct and paralysis of the penis. The true cause of these conditions is unknown, but forcing the birds into production is thought to play a part. All birds thus affected should be removed from the breeding flock immediately. Removal prevents other ducks from picking. Ducks that have a tendency to prolapse of the oviduct or paralysis of the penis should not be used in a breeding flock even if they recover.

Impaction of the oviduct may result from an infection of the glands that secrete the egg constituents. There are probably other unknown causes.

Internal layers are found occasionally in laying ducks. Reversed peristalsis in the oviduct causes the fully formed eggs to drop into the abdominal cavity. Ducks so affected become thin and die.

Ascites, or water-belly, is a common condition in ducks. The accumulation of fluids in the abdominal cavity is usually the result of some interference with the circulation of blood from the intestine and through the liver.

The incidence of tumors in domestic ducks is extremely low. Tumors of the liver, lungs, kidneys, and oviduct have been reported in ducks.

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